HOME DRIVEWAY CONSTRUCTION

Homeowners will sing your praises if a little extra care is taken.

THERE WAS A TIME when concrete contractors assumed that the private driveway market was in their pocket. They could lean back on their laurels and still get a healthy income from this area. Such jobs, although not sizeable in themselves, often added up to a good share of the over-all profit picture.

Recently, however, a certain dark colored paving material has been taking an ever growing bite out of this market. Black driveways, once an unusual sight, are now commonplace on the American scene. The only way to compete successfully with flexible paving is to stress the superior quality and longer life inherent in concrete driveway construction. The sight of a scaling, cracked, unsightly concrete driveway and the loud wailings of its owner can soon lead to a loss of a good share of this market to competitive paving materials.

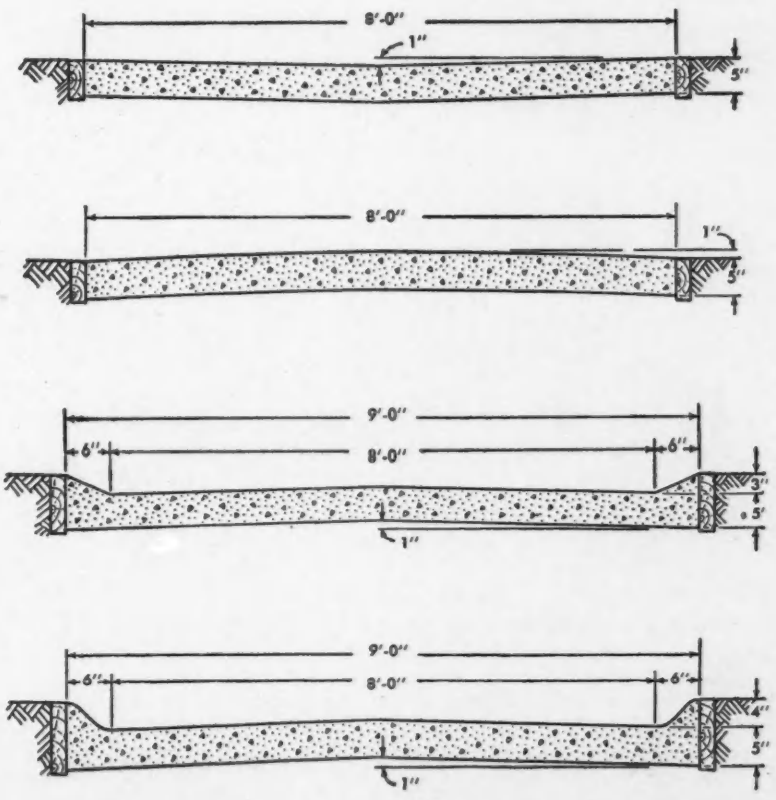
It's particularly unfortunate that there are failures in concrete driveways because just a little attention to a few details can mean the difference between a disgruntled customer and a happy, tireless salesman who demands neither pay nor thanks.

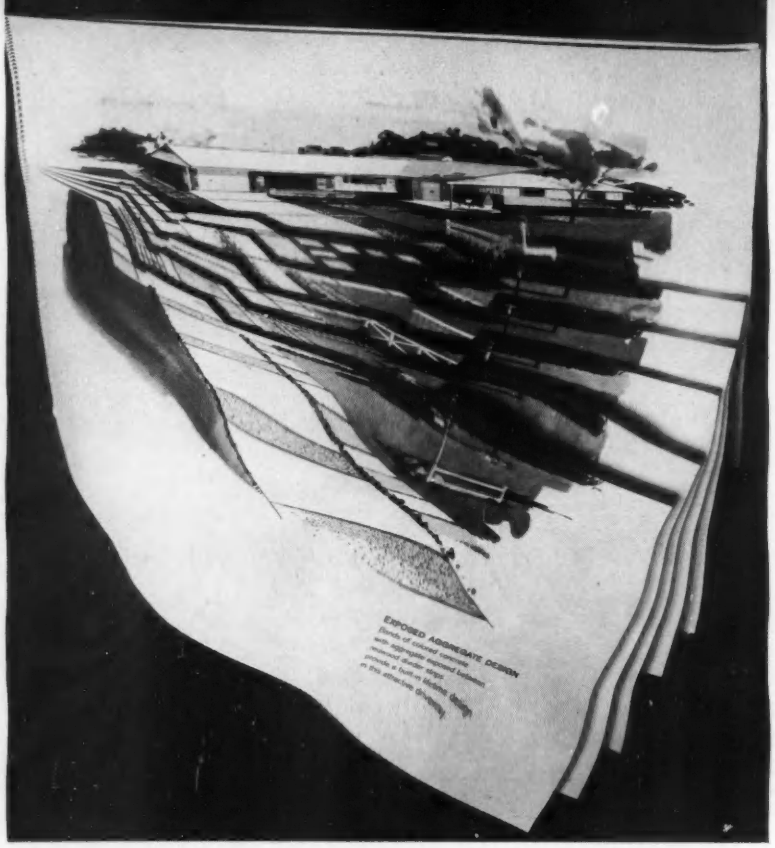
quoting

Although construction or replacement of a driveway does not involve an appreciable sum of money as far as the contractor is concerned, it often represents a major cost item in the homeowner's budget. As such, he is likely to take a keen interest in some of the details involved in the construction of his driveway. Because you are selling a quality product (one which is usually higher priced than its competitors) time should be taken to explain why it is superior to its rivals.

By emphasizing the several advantages of concrete driveways—long life, skid resistance, low maintenance, beauty—you can make certain that potential customers will be more kindly disposed toward your quote. People instinctively like the things they understand. If you give enough information to set him up as something of an expert on why he paid a little more for a concrete driveway, the homeowner will be much more likely to be convinced.

After the type of driveway has been selected the layout and width of slabs should be chosen and approved by the owner. Drainage is important in this work since a driveway cov-





driveway promotion aid

Pictured above is an attractive 15- by 20-inch booklet which has just been published to serve as an aid in promoting wider and better use of concrete driveways for residences. Spiral bound and printed in four colors, this effective selling tool utilizes a series of overlay sheets to show a few of the many striking effects which can be achieved through imaginative design of the driveway as an adjunct to modern home construction. Included are swirled, patterned and raked textures, as well as exposed aggregate finishes and ribbon and patio block designs. Single copies may be obtained without charge from the nearest district office of the Portland Cement Association, or by filling out and mailing the reader service card in the center-spread of this magazine.

ered with ice can be of little or no use. In addition, water will tend to cause differential settlement and/or washing out of portions of the subgrade. Fortunately, it is often possible and practicable to grade the approach to the garage; this facilitates drainage, especially when the grade terminates at a street gutter with adequate sewers. The driveway can also be crowned transversely to prevent water from standing on the slab.

construction

SUBGRADE. One of the aspects of driveway construction that is often slighted is preparation of the subgrade. Since driveways are of slab-on-grade construction, it is the subgrade which must supply the structural strength. The slab itself cannot bridge portions of the subgrade that settle or are washed out. Therefore, if the slab is to remain intact, a stable subgrade must be provided. This is true for both the one-piece and double-ribbon types of driveways.

The sub-soil should be tested for compaction. An easy way to test compaction is to run a heavy automobile or a light truck over the excavated driveway site and observe the condition of the ground. If it is appreciably disturbed — displaced or sunken — it will be necessary to compact it further. In some areas the soil is of such a nature that it must be dug up and a subgrade material laid. There are machines available to compact such subgrades. Contractors who do an appreciable amount of this type of work will find it to their advantage to acquire such a piece of equipment.

If proper preparation of the subgrade is slighted, no amount of attention to the other aspects of driveway construction will forestall rapid breaking up of the slab.

FORMWORK. Usually, 2x4, 2x6 or 2x8 lumber set on edge is used for driveway formwork, depending on the slab depth desired. Private driveways are normally from five to six inches thick. The side forms should be rigidly braced with stakes on the outside of the forms. Drive them firmly and deeply into the ground and butt them up right next to the forms. While wood stakes are still used to some extent, many contractors are switching to reuseable steel stakes which do a better job and in the long run cost considerably less.

Stakes should be at about one foot intervals. Forms should be set flush with the soil level and set to true line. Tamp earth along the forms to help keep the boards secure during placing of the concrete and finishing operations.

REINFORCING. There's quite an argument raging around the necessity for reinforcement in slab-on-grade work. Both sides seem to have brought forth good arguments for their particular stand.

Adherents to the pro-wire-mesh school claim that it holds the slab together and controls cracking caused by occasional structural overloads or thermal variations. The most common size used for driveway construction is 6x6 6/6, stocked by most building supply dealers in five or six-foot wide rolls.

If wire reinforcement is to be used, it should be located at or slightly above the center of the slab. Placing it on the subgrade and prying it up as concrete is placed will not accomplish this. It must either be supported on reinforcement chairs (makeshift ones are sometimes made from bits of brick, block, stones, etc.) or a layer of concrete can be placed and the wire laid before concreting is completed. The latter method, of course, calls for some quick action by workmen to avoid setting up of the concrete before it can be placed and finished. Wire reinforcement should be overlapped at least one wire spacing to achieve continuity of reinforcement action.

Others doubt the value of wire mesh in slab-on-grade work. They call attention to studies conducted by the American Concrete Institute which

indicate that to obtain any noticeable amount of crack control there is needed 0.8 per cent cross-sectional area of steel in a slab-on-grade. This amounts to 0.48 square inches of steel per foot of five-inch thick floor.

To achieve this steel area, #4 bars five inches center-to-center would be needed in a five inch thick slab. The heaviest wire reinforcement available (which comes in mats weighing 107 pounds per 100 square feet) is 6x6 0/0. This would provide 0.148 square inches of steel. The mesh most commonly used for driveways (6x6 6/6) provides 0.058 square inches of steel—approximately one-tenth the amount needed according to the ACI study. Proponents of this view believe that the money expended on wire reinforcement would be more effectively spent on increasing the thickness of the slab.

In any case, it should be recognized that steel in slabs-on-grade is for crack control only; no claims are made for increasing structural strength. Since the greatest amount of movement is caused by thermal variations, which are greatest at the top surface of the slab, any steel used should be placed relatively close to the top of the concrete.

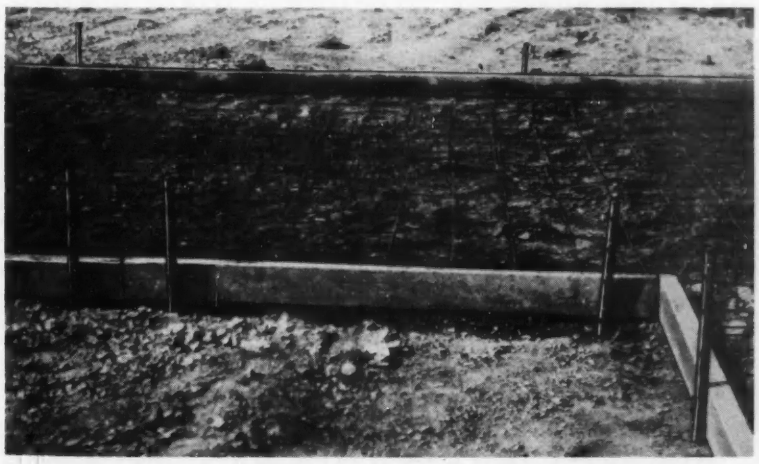
CURING. When ordering concrete, remember that driveways are subjected to considerable loads and salting will probably be frequent and plentiful. Maximum aggregate size should be about one inch and 5½ sacks of cement per cubic yard, not more than six gallons of water per sack of cement, and a slump of three to four inches should be specified. BE SURE the concrete also contains a sufficient quantity of an air entraining agent to produce approximately five or six percent air. Present knowledge indicates that this is the only way to assure freedom from scaling and damage from freezing and thawing.

If the driveway is long, 20-to-25-foot long slabs should be cast alternately. The fewer joints provided, the wider will be the openings at the joints. After the odd-numbered slabs have been poured, the divider strips can be pulled and the even-numbered slabs poured against the hardened sections. Paper, plastic film or some other material should be placed between the slabs to prevent bond between the slabs so that the joints will operate properly. Remember that isolation joints will also be needed. They should be placed wherever the driveway slab butts up against a building or against slabs of a different shape or thickness.

Concrete should be thoroughly spaded, tamped or vibrated to ensure consolidation. It should be screeded to a level slightly above the form boards using convex boards to give a crowned effect. Wait until the concrete has set up sufficiently to support a man without leaving more than about ½-inch deep impressions of his heels. Then finish with a wood float and broom transversely to lend skid resistance to the surface.

Curing is another highly important phase of concrete driveway construction as well as all concrete work. Curing often makes the difference between a highly satisfactory job and one that cracks up and performs poorly. The cost of curing paper or plastic film for this type of job is small indeed when compared with the great returns on the investment. It would be well to caution the homeowner to keep a watch on the covering to make sure that it remains in place. He should also check to see that the slab does not dry out. Driveways should be cured at least five days and preferably one week to ten days.

Forms and reinforcing wire fabric in place ready for placing of concrete. Steel stakes which brace the form lumber are reusable and more efficient than wood stakes.



decorative driveways

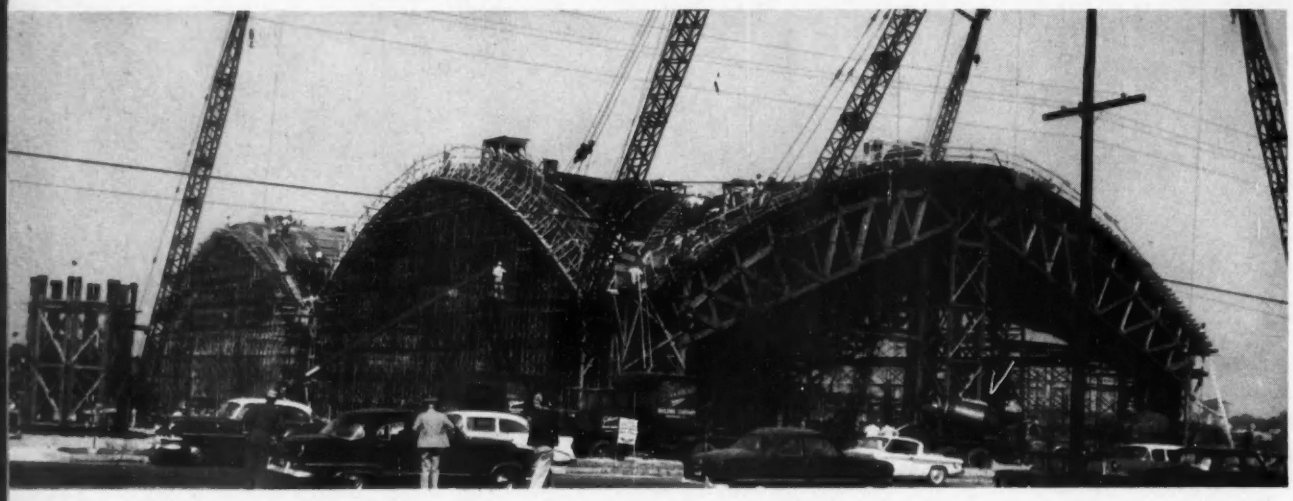
With the advent of "status seekers," "togetherness," cleaner community drives and the like, the average homeowner today is more conscious than ever before of the appearance of his home. Thanks to the plasticity of concrete, a great number of designs and color effects are possible with concrete driveways. If you can show your potential customer the beautiful, unusual designs that are possible with a concrete driveway, he will be that much more likely to pay the extra money to get a quality product.

Best of all, most of these decorative effects can be obtained with very little extra expense and/or effort on your part. Take brooming, for example. Instead of the usual straight, transverse strokes, a zig-zag pattern can be used. Or squares can be set off by brooming in opposite directions. If alternate slabs are being cast, contrastingly colored concrete can be used. For an extra special, luxurious driveway, colored aggregate can be rolled into all or part of the surface of the partially hardened slab. Two or more of these techniques can be combined with telling effect.

Concrete driveway construction is a straight-forward proposition. Attention to a few important details, a little imagination and a good selling job is all that is needed to put the market right back in your pocket—where it belongs. END

SOME DRIVEWAY MUSTS

1. **Prepare the subgrade thoroughly.**
2. **Use an air entrained concrete mix.**
3. **Provide adequate, properly spaced joints.**
4. **Be sure that good drainage is provided.**
5. **Finish with a texture for skid resistance.**
6. **Cure for at least five days.**



mammoth thin-shell roof

The placing of a reinforced concrete, thin-shell "elastic" roof for the world's first fully-mechanized post-office in Providence, Rhode Island, is said to be one of the most precise construction efforts of its kind ever attempted. Covering an area of 145,-000 square feet, the 7,000-ton roof is a 6-inch shell of reinforced concrete with 8 concrete stiffener ribs moving diagonally from the center and at the edges.

This is the first thin-shell concrete roof of spans over 60 feet to be erected on elastic supports which are designed to permit the roof to move slightly on its column supports in response to atmospheric and temperature changes according to Intelex Systems, Inc., contracting firm.

A huge bed of shaped plywood was built, supported by 52 specially designed wooden trusses, ranging in length from 10 to 75 feet and radiating from a timbered center tower 56 feet high. This plywood bed provides the form on which the concrete is placed in 6 sections or bays. As the placing of each bay is completed —and the concrete has set—the supporting tower is lowered, laid on its side and moved out intact. Then the plywood form, with its trusses, comes down in pie-shaped sections, is moved and immediately re-erected on the tower and columns for the pouring of another bay.

Timing and control of movement is important. The concrete used is a type calculated to reach its design strength in 7 days instead of the customary 28 days. The aggregate is a light-weight expanded shale which gives lightness without sacrificing strength. Because the setting time is critical—the concrete sets two hours after placing—the mixture must be delivered and placed within minutes.

To insure a steady, uninterrupted flow of concrete to the site, police are stationed at strategic street corners in Providence to avoid delay of mixers in traffic. At the site itself, dispatchers are on hand directing each truck to one of five derricks to insure an even flow of concrete as it is poured upward from each corner.

Temperature and air moisture are equally important, too. Before placing is started temperature is carefully checked. The forecast must show no rain for 48 hours and temperatures under 90 degrees for 24 hours.

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WILLIAM M. AVERY
editor and publisher

JOHN M. ENGLE
co-publisher

CLARISSA B. McKNIGHT
business manager

DOROTHY LUXFORD
distribution manager

eastern representative
WALTER J. MASTERSON, JR.
Essex, Conn.
P. O. Box 206, South 7-1838

pacific coast representatives
DUNCAN A. SCOTT & CO.
Los Angeles 57
1901 West 8th St., Dunkirk 8-4151
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85 Post Street, Garfield 1-7950

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More power to concrete . . .

ULTIMATE STRENGTH THEORY MODERNIZES CONCRETE DESIGN

FOR CENTURIES CIVIL ENGINEERS have been striving to devise design techniques that would indicate exactly how much material and exactly where it should be placed to satisfy the structural needs of different types of construction. Modern man marvels at the ingenuity displayed by the ancients in building their aqueducts, temples and even their sewers.

In our time, and notably in the United States, new design techniques are looked upon with grave suspicion —especially those that reduce the amount of material specified. Such designs usually face long proving periods before they are accepted. Perhaps it is just as well that building code officials, the guardians of these matters, do require extensive proof before granting their stamp of approval. However, ultra-conservativeness does discourage experimentation.

A design method based on the ultimate strength theory seems destined soon to supplant the current American technique. Most American engineers now use the straight-line or elastic method, adopted in 1909 in the United States, for the structural design of concrete buildings. It has proven trustworthy over the decades that it has been in use; but it has long been acknowledged to be unduly conservative under certain conditions.

Europeans have been using ultimate strength design for many years (it actually predates the elastic method) and with excellent results. It has been employed for the design of the many spectacular concrete buildings in Europe and South America that have helped to stimulate the imagination of United States designers and builders. It has worked well despite the reduced safety factors which are prevalent abroad.

The major advantage that ultimate strength design offers over the elastic method is that it results in a design that much more closely reflects actual structural requirements under all conditions. While a comparison of designs for small or lightly loaded structures produced by the two methods might indicate only slight differences (if any), for a high building (for example, a 15-story apartment building) or a structure with a considerable dead load, ultimate strength design would result in a considerable saving in construction materials. The saving would be most pronounced in the load bearing members—the walls or columns.

The design for a recently constructed building accommodating 200 apartments illustrates the saving attainable by ultimate strength design. The frame for the building cost approximately $450,000. Use of ultimate strength design resulted in a saving of 10 percent, or $45,000. In materials for the columns, the reduction amounted to 20 percent of the concrete, 45 percent of the reinforcement and 15 percent of the cost of the formwork. A reduction of 10 percent of the reinforcement was possible in the floor slabs.

In contrast, when the live load (automobiles, stored materials, etc.) is the determining factor, ultimate strength produces a design which is roughly the same as that derived by the straight-line theory (indeed, in some cases it may result in slightly larger members).

In all cases, however, there is a reduction in the amount of time required to produce a design with ultimate strength. When United States engineers become better acquainted with this technique, the cost of producing plans for concrete structures—long a deterrent to the wider use of concrete —should come down substantially.

In general, the acceptance of ultimate strength design (it is already accepted in the building codes of such cities as Philadelphia, Kansas City, New Orleans, Dallas, Spokane, Boston and Pittsburgh) marks the beginning of an era in which concrete will be able to compete most advantageously with other structural materials.

Important architectural advantages (notably smaller columns) are also very much in the picture. This will mean more business and bigger profits for concrete contractors throughout the country. END

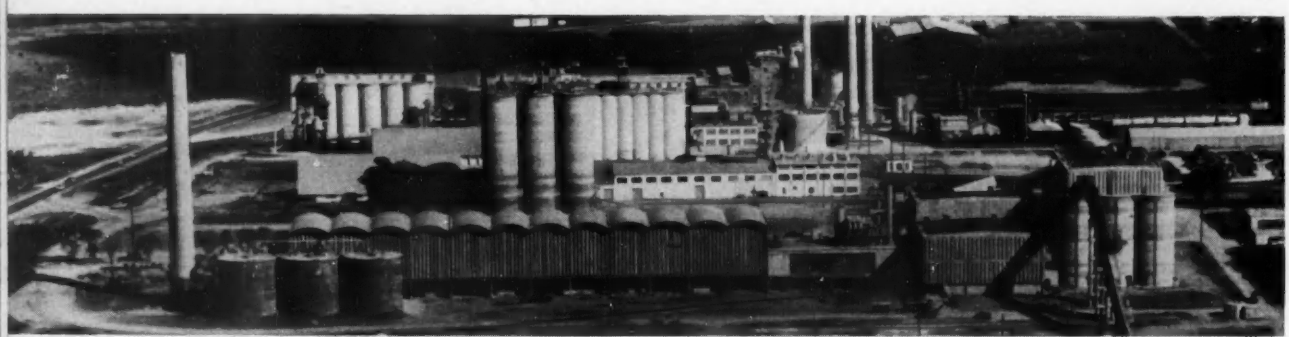
Novel system of moving forms

holds costs in line on thin-shell roof project

A 100-TON ROOF FORMING MACHINE

AN INGENIOUS and yet strikingly simple adaptation of portable forming has shown substantial savings in the construction of twelve thin-shell roof arches for the new 3,000,000-barrel cement plant of Ideal Cement Company at Ada, Oklahoma. The problem: to roof an overall area measuring 103 by 480 feet at a height of 75 feet above floor level, and to do this without interfering with the operations of a 450-foot cement kiln already installed within the structure. The 40-foot wide arches span 80 feet between supports with 12-foot cantilevered extensions at each end.

Steel bow string trusses covered with plywood were used to form the arches, and portability was obtained by means of two movable steel towers erected on the side of the building available for work space. On the other side of the building, in order not to interfere with operation of the existing rotary kiln, bents were clamped to the building columns to support the full load during and immediately following cast-



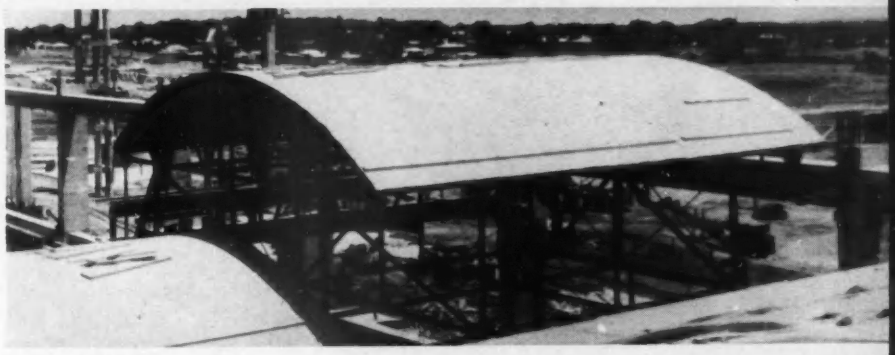
Photos courtesy Fruin-Colnon Contracting Co.

Aerial view of Ideal Cement Company at Ada, Oklahoma. New kiln building in foreground has concrete panel walls capped with a thin-shell arch roof.

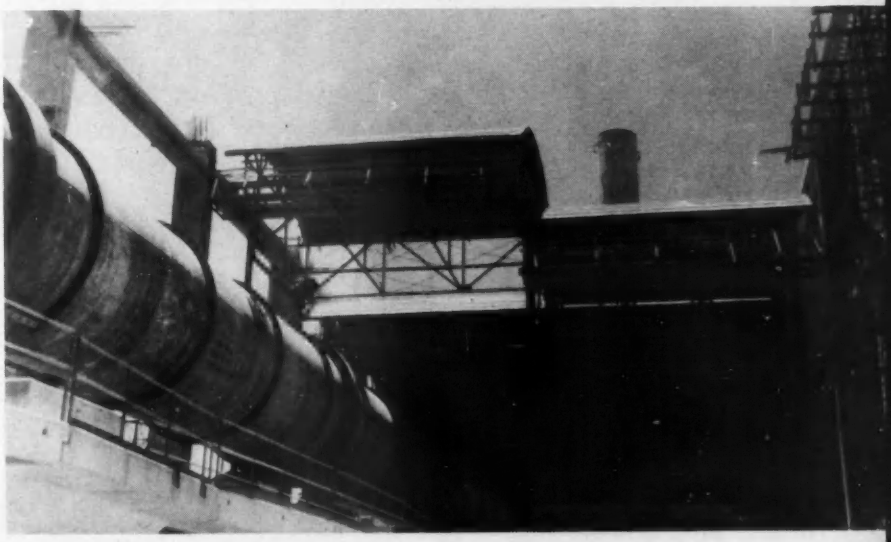
ing operations. The arches were cast in pairs and after each casting operation the trusses were lowered to clear the edge beams and then moved forward by shifting the supporting towers and bents.

In order to facilitate both the design and the operational procedures to be followed, a complete scaled working model was made. The extra time and expense entailed in this type of planning paid off handsomely by

FILE: Thin Shell



Close-up of one section raised to height at which concrete is placed. Forms have just been moved ahead and the other four sections are in their lowered position.



View after sections have been moved ahead with one section raised. Economical use of steel is apparent. Working over the 450-foot rotary kiln at the left was just one of the many problems which had to be solved.

Partially completed roof of kiln building. Four bays at right have been cast. In two bays just to left of center the forms are in position. On the ground are two cantilever sections waiting to be lifted into place.

forestalling hitches and delays when the actual work got underway. The raising and lowering of the arch forms was accomplished by means of a system of cables and winches.

The designers had intended the arches to interact with one another in groups of four, and thus to be cast monolithically in groups of four. Since there could be a substantial saving in both labor and material by casting only two arches at a time, the contractor developed a somewhat novel system for assuring that adjacent pairs of arches would interact just as though they had been cast together. Edge beams between adjacent pairs of arches were carefully checked for both lateral and vertical deflection after the forms had been removed, and then lifted and pushed to their original positions by means of jacks and hydraulic gear pullers while reinforcing was being placed and the next two arches cast. By means of careful pressure-gage determinations and elaborate precautions to maintain recorded pressures, it was possible to obtain a high degree of interaction between adjacent pairs of arches. END

Some things you should know about the effects of concrete on aluminum

ALUMINUM IN CONCRETE

By R. I. LINBERG*

ALUMINUM IS WIDELY AND SUCCESSFULLY USED in contact with concrete. But in spite of its long history of acceptance, the use of aluminum in concrete, mortar, or plaster is occasionally questioned on the basis that these materials show a definite alkaline reaction.

The complete picture of what happens when aluminum is in contact with concrete involves differentiating between surface attack and attack involving structural damage to aluminum. When aluminum is in contact with fresh concrete, a surface reaction does occur between the aluminum and the alkaline constituents of the concrete resulting in a slight superficial attack on the metal. This attack occurs over the first four or five days and then subsides. In this four- to five-day period, aluminum will be etched to a depth of ½ to 1 mil (1 mil = .001 inch). The depth of attack after one year will generally be less than 2 mils and little additional attack is noticed thereafter. Unless there is frequent intermittent wetting and drying, no appreciable corrosion will take place and no deterioration of the properties of aluminum will occur except in very thin sections. Under continuously wet conditions aluminum in concrete is only slightly attacked. Research done in the laboratories of the writer's company shows a maximum attack of 1.7 mils on aluminum exposed for one year in concrete.

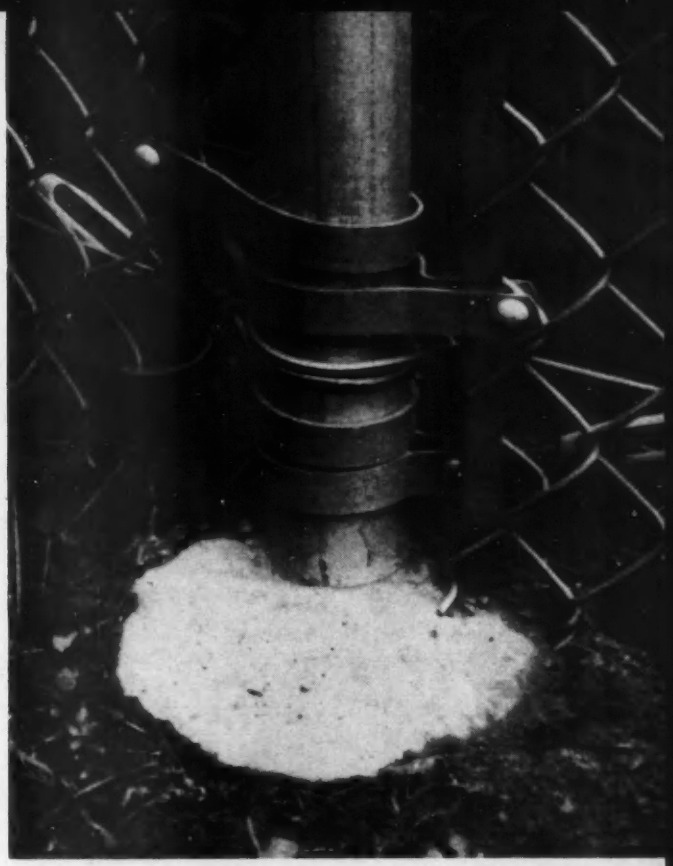
As far as structural integrity is concerned, the attack by cement or mortar is of no consequence. As far as appearance is concerned, such attack may be intolerable. Therefore, in areas where aluminum is exposed, it must be protected from splashes or droppings of mortar and plaster. Such protection is afforded by an easily removed coating such as strippable plastic or an oil. Indeed, used crankcase oil will protect the surface temporarily and can easily be removed with solvent or soap and water. A clear methacrylate coating properly applied will also protect aluminum and need not be removed.

There are a number of special types of concrete made for special purposes, in all of which aluminum performs without difficulty. In heavy aggregate concretes consisting of magnetite aggregate in portland cement, aluminum lost a maximum of 2 mils in a year's exposure. When this heavy aggregate cement was maintained in a continuously wet condition, aluminum exhibited an occasional pit up to 10 mils in one year. (Work done for Reynolds Metals Company by the University of Louisville.)

Aluminum performs equally well in magnesium oxychloride cements. Here again, an initial etching occurs and then attack slows down to practically nothing. When aluminum divider strips are used in terrazzo flooring, it is advisable to coat them with a clear methacrylate coating to prevent the superficial attack. Such attack releases small amounts of hydrogen and causes small crevices adjacent to the aluminum. Crevices, and the water

*Corrosion engineer, Reynolds Metals Company, Richmond, Virginia.

Some simple examples of just a few of the many ways in which aluminum and concrete come together in modern construction. Above: an aluminum post set in concrete. Below: aluminum conduit protruding from a concrete slab.



which can collect in them, can cause increased corrosion in applications such as flooring.

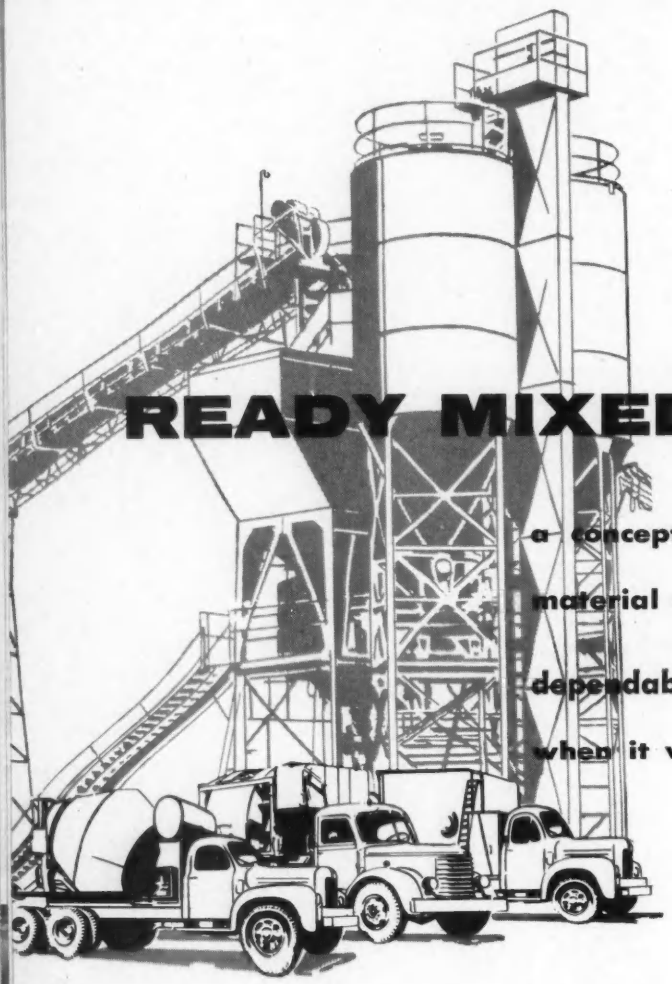
Additions of chlorides to concrete are frequently made and, in general, such additions cause no adverse effect on aluminum. Corrosion during the setting period may proceed more rapidly but once the concrete has set, the action ceases.

The addition of chlorides (either as calcium chloride or in magnesium oxychloride cement) can aggravate galvanic corrosion of aluminum in concrete. Such galvanic attack is not peculiar to concrete and, in fact, the concrete serves only as a medium for carrying the liquid solution (electrolyte) necessary for galvanic corrosion. Wright, Godard & Jenks (Engineering Journal, October 1954) have this to say: "Calcium chloride additions to concrete mixes do not cause an increase in the corrosion rate. However, some work recently completed indicates that if stray electric currents are present, corrosion may be greatly increased. Also, where aluminum is embedded in concrete containing calcium chloride and is in contact with steel similarly embedded in concrete, appreciable galvanic corrosion of the aluminum may occur, especially under damp conditions."

Galvanic corrosion can be prevented if aluminum is not allowed to contact other metals such as steel reinforcing rods. Prevention of attack is simply and inexpensively obtained by coating the aluminum with an asphalt or bituminous paint over the areas of possible contact. Plastic tapes will also prevent contact. Where aluminum is in contact with concrete containing calcium chloride and will remain permanently damp, it is well to coat the aluminum as already described.

Inasmuch as crevices tend to promote the corrosion of aluminum, they should be eliminated wherever possible. For instance, when aluminum extends through a concrete surface, crevices can be formed at the aluminum-concrete jointure. Again, a bituminous paint over the contact area will prevent corrosion. In such a case, an aluminum pigmented paint will not mar the appearance of the aluminum.

To summarize, aluminum is not affected beyond a slight surface attack by concrete, mortar, or plaster either with or without usual additives in all normally encountered environments. When dissimilar metals are in contact with aluminum in concrete, the aluminum will suffer accelerated attack; however, inexpensive paints are available to prevent this type of attack. END



READY MIXED CONCRETE...

a concept of how to get a vital construction material delivered to job sites economically and dependably that still looks as good today as when it was first proposed some 40 years ago.

WHILE THE REST OF THE ECONOMY has been expanding cautiously at the rate of three percent per annum, the still-comparatively young ready mixed concrete industry hit a galloping seven percent clip in 1958 and may have topped that in 1959. This happened while professional economists were telling the country that we were in for a sustained season of runaway inflation or endemic deflation.

As it turned out, the economy did pause for a breathing spell before resuming its upward climb, but the hiatus didn't materially affect the ready mix industry. One reason, of course, is that the construction business did not decline as much as steel, autos and electrical equipment, the so-called barometers of our economy. Another factor is that U. S. capitalism, unlike European systems, based on cartel arrangements, offers an advantage to business men who provide a better product at a lower cost than their competitors.

Ready mix producers also continued to expand their market partly because much construction is unaffected by temporary recessions, due to long range plant expansion plans and continuing federal projects, such as the federal highway program, public housing and urban renewal. More important to the future of the industry, contractors were at last learning that job-mixed concrete costs more money to produce, is more expensive to place and offers problems in quality control that many contractors cannot solve.

U. S. contractors, caught in the profit-crushing squeeze of rising materials prices and wages, are finding it necessary to watch their costs more closely than ever before. To many of them differences in the cost of a single material, and the labor required to use it, can mean the difference between coming out on a job or losing money.

Ready mix as an answer to at least part of this problem has no stronger advocate than Jim St. Clair, executive secretary of the National Concrete Contractors Association, a nationwide organization with headquarters in Chicago.

"Costs on job-mixed concrete often run twice as high as ready mix," he said in a recent interview

FILE: Job Practices

with a construction reporter, "and you don't have one-tenth the labor problem."

It is no coincidence that ready mix is proving most economical on all kinds of jobs from highways to high rise apartment buildings. In Chicago, a city that has turned almost exclusively to high rise dwelling units to solve its housing problem, 98 percent of all such structures are of reinforced concrete frame with glass or masonry and occasionally metal skin curtain walls. Ninety percent of these units are made with ready mixed concrete.

Although ready mixed concrete has always been popular on medium size and smaller jobs, until a decade ago contractors on the larger projects were hesitant to use it. A number of factories have brought about a radical change in this picture.

The general trend towards longer financing periods means that structures must be designed to last longer and operate with lower maintenance costs. Developers of a privately financed apartment project in a typical large city may borrow money for as long as 40 years. Certainly the buildings must last for the period of the mortgage and be reasonably inexpensive to maintain during that period. Then the building must have an earning life after the mortgage is cleared.

These money factors have meant more consciousness of initial construction costs, maintenance costs and corresponding emphasis on durability of materials. All these considerations have worked in favor of concrete generally. Since the reinforced concrete frame and floor structure has come into its own, the burden of proof of quality rests on the concrete in the structure. This has brought the whole subject of quality control into sharper focus than ever before. While even its strongest partisans would be the first to admit that ready mix is not a cure-all for quality control problems, it unquestionably provides the means of meeting standards and specifications within narrower limits than can usually be maintained with job site batching and mixing. When this potential is fully developed by both the producer and the user of ready mixed concrete, as is being done today on countless construction sites, the inevitable result is better concrete.

Then there is the labor problem. Semi-skilled labor such as that usually used to mix concrete at job sites has proved itself anything but reliable although this labor commands a wage scale which is often higher than that of skilled workers in other industries.

"The simple truth," wrote one disgusted contractor with whom this problem was discussed, "is that most of the labor is transient. They won't be with you on the next job and they know it. They just don't care about how much water they add to the mix. They have a deep conviction that the real enemy is the job. Slow it down, make it last, don't let it get the best of you."

The ready mix producer is not plagued with the same problems. His labor is not transient and none of it is unskilled. His aggregate stock piles enable him to control moisture content within very narrow limits. His batch bin operator is a skilled technician whose job depends on his delivering the right mix into the truck mixer every time. The ready mix producer's business depends on his delivering a product of the required quality on schedule. His costs are largely fixed and he gains little in the long run by cutting corners.

Through its National Ready Mixed Concrete Association, formed in 1930 with headquarters in Washington, D.C., the ready mix industry has worked dilligently to standardize control procedures, measuring devices and testing, and in general has maintained a concerted effort to improve the quality of concrete. It is perhaps the best measure of the caliber of the men who have been in the forefront of this effort that they themselves are far from satisfied with the achievements to date. But significant progress has been made and continues to be made.

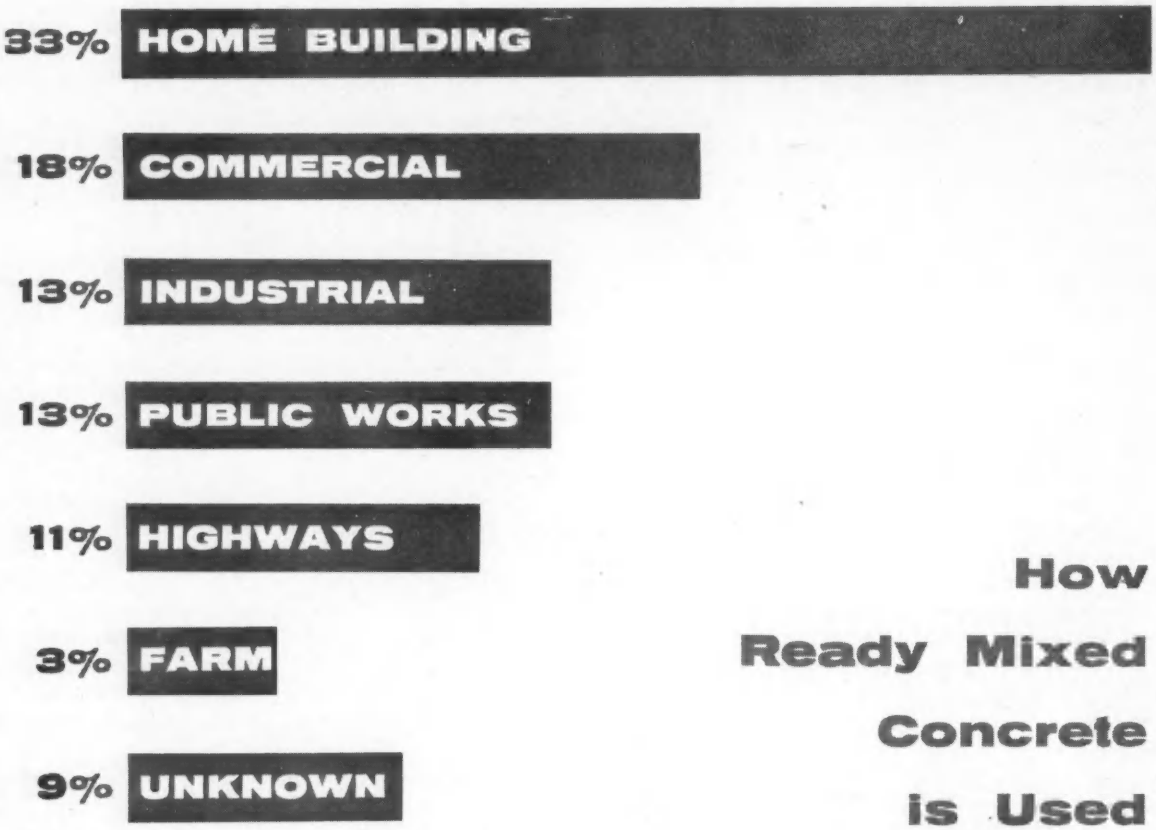
In the final analysis, however, a product sells itself by its performance on the job. Advertising helps; publicity may get people interested in the product and salesmen undoubtedly sway the undecided, but the product stands or falls by the way it performs on the job.

In 1958 the Portland Cement Association, at the request of the National Ready Mix Concrete Association, undertook the fourth in a series of surveys to find out what contractors think of ready mix as a product. The results indicated that only a small number of contractors were seriously dissatisfied with the product.

The survey disclosed that 23 percent of the users of ready mix can be classified as large contractors, using over 10,000 cubic yards a year. Fifty nine percent of the users of ready mix buy 1,000 to 10,000 cubic yards a year while 18 percent of the contractors use under 1,000 cubic yards annually.

Contractors as a group are probably the shrewdest dealers in the economy. In their business, with risky gambling on everything from weather to the performance of the subs on the job, they have to be. A stretch of bad weather can cost a contractor on a big job thousands of dollars; one inefficient subcontractor can hold the job up for days. Under tight schedules and performance bonds this can mean disaster.

Yet 52 percent of the contractors surveyed said they had no complaints about ready mix. Only 4 percent had three complaints and 30 percent had only one complaint about the product. Eighty-five percent of the contractors polled said they were satisfied with the quality of the product. Sixty-eight percent of those surveyed said they were satisfied with the price of ready mix and only 3 percent complained about a short count on the



How Ready Mixed Concrete is Used

Based on a survey of 1958 production conducted by the National Ready-Mixed Concrete Association

dispensing of the product, a remarkable record for honesty considering that there is no really accurate way to measure the amount of ready mix discharged from a truck mixer.

Perhaps the most astonishing fact uncovered in the survey was that the average contractor does business with the same ready mix producer for 10 years before changing. Those contractors that changed suppliers gave as the most important reason the fact that the new supplier was located nearer to the job-site. Significantly enough, only 9 percent of those who changed to another supplier listed poor quality as the reason for the change. Only 7 percent said the price was too high.

Although contractors are definitely satisfied with the price and quality of ready mix, there is some evidence that the industry can do quite a bit to expand its market if the producer will sit down with the contractor before the beginning of a big job and discuss mutual problems.

This failure in liaison is at least partly due to natural differences of opinion among producers, contractors and engineers concerning ready mix and its uses. The boundary of the meeting ground between these sometimes opposed points of view is Stanton Walker's classic definition of ready mix as "a processed material which in a plastic state is sold as a finished product ready for use now."

Walker is the first to admit the inadequacy of this definition. As head of engineering for the National Ready Mixed Concrete Association, he deals continually with problems that arise because concrete does not entirely live up to this definition.

Many of these problems can be traced to the fact that concrete, almost alone among all materials of construction, reaches the job site in a highly vulnerable and perishable state. It changes from its plastic state to a harder-than-granite condition and the time this process takes depends on the circumstances. While builders are definitely interested in quality concrete, they are also interested in its workability or consistency.

Though contractors and ready mix producers may not always see eye to eye, basically they have

much in common. Each is a small business man. The business is primarily local in character and does not easily lend itself to the kind of combinations that have taken place in the steel industry, for example.

Each is a rugged individualist in the classic sense of the word and each comes by his individualism naturally. In the case of ready mixed concrete, individualism is a tradition based on the rapid growth of a relatively new industry. Baltimore, Maryland, and the year 1913 saw the first ready mixed concrete processed at a central mixing plant and delivered to a job-site in a dump truck.

Part fish, part fowl, the industry floundered helplessly for a while due to lack of mobile equipment to haul processed concrete from a central mixing plant to the job-site. By 1916 Stephen Stepanian, often called the father of the ready mix industry, had applied for a patent on a truck mixer designed along the principles of current transit mixer models.

A Milwaukee concern finally agreed to build Stepanian's truck mixer. When it came off the production line, it resembled nothing so much as a tank on house rollers. The power unit couldn't budge the loaded mixer, barely moved the truck with the drum empty. After this discouraging start, a decade went by before the Paris and Barrymore mixers came sweeping out of the West to corner the market for a time.

Before the appearance of the truck mixer, the central mix plant came into its own. By 1929 more than 100 ready mix plants were in operation, most of them of the central mix variety. Today central mixing accounts for less than 30 percent of all the ready mix currently in use.

The 1929 business collapse crushed most industrial expansion but not the ready mix industry. In 1930 no fewer than three different manufacturers entered the market with a full line of truck mixers and agitators of different capacities. Since the thirties the growth of the industry has been phenomenal. By 1941 there were 703 commercial ready mix plants in operation with a combined production of 12 million cubic yards. Ten years later the industry comprised 1,700 plants and a combined production of 50 million cubic yards.

The introduction of the high-discharge mixer in 1938 gave the industry a tremendous shot in the arm, but then it was evident to all observers that the use of ready mixed concrete was bound to undergo rapid expansion because the product itself is such a logical one with which to serve the building industry. In the ensuing years planned inflation, NRA, the rise of labor unions, World War II and Korea all combined to increase the demand for the services of contractors and at the same time force their costs upward, usually faster than their profit margins. Thus a vacuum was created and ready mixed concrete proved to be the logical product with which to combat the rising cost spiral.

Today the ready mix industry uses at least 45 percent of all the cement produced. The concrete output of the 1,792 companies replying to a recent survey by the National Ready Mixed Concrete Association is more than 81 million cubic yards annually. These companies use more than 108 million barrels of cement every year. Approximately 3,448 ready mix companies are doing business in the United States today and the 81 million cubic yards of production reported in the survey is believed to represent about 80 percent of total U. S. production.

Total value of the U. S. production last year was $1,114,355,650. Home building continues to be the largest market for ready mix, accounting for 33 percent of current production. In second place was commercial construction, followed by industrial building.

What about the future? No one will seriously question that the ready mixed concrete industry has made a real and lasting contribution to the science of concrete construction by bringing high standards of closely controlled quality in the production of concrete within reach of even the smallest job operating on the slimmest budget. It is precisely this fact which accounts for the tremendous growth of this still young and growing industry.

Essential to that growth has been a history of demonstrated integrity, for the ready mix producer is in no way at all a fashioner of miracles. He owns no facilities and makes no claim to skills not accessible to everyone else, and he holds no basic patents or answers to obscure mysteries. Indeed, his only real stock in trade IS his basic integrity and his past performance, for this is not by any means a one-shot supply business, with great numbers of new and innocent victims waiting in line to be disillusioned. The producer of ready mixed concrete must in the long run stand or fall on his ability to hold the allegiance of his customers, and he must do this with the constant knowledge that only economies and convenience prevent those same customers from setting up their own facilities of production.

Sobering as this knowledge is, it has given the construction industry one of the best guarantees of performance it could have. Because of this, ready mixed concrete has consistently outgained the economy as a whole, the construction industry in one of the greatest booms in history, and even the portland cement industry in its longest sustained period of expansion. Concrete construction will continue to gain in the over-all construction picture, and ready mix will continue to gain in the concrete construction picture, just as long as ready mix continues to stand for the quality, service and performance builders insist upon. END

book reviews

1959 Compilation of Rental Rates. *Published by Associated Equipment Distributors, 30 East Cedar Street, Chicago 11, Illinois. $6.00.*

Slight increases in rental rates for over 1,500 items of construction equipment are reported in the 1959 Compilation of Rental Rates, published recently by the Associated Equipment Distributors, national trade association of the construction equipment industry. The book reports national average rates, based on a nation-wide survey conducted last summer among some 850 distributor members. It is significant that national average rates for some popular rental units are down from a year ago.

AED's rental committee stated that lower rates reported for particular sizes of compressors, truck mounted cranes, power shovels, scrapers, and torque converter drive tractors—as examples—are not surprising in the face of stiffer competition in some areas for rental business. Another influencing factor, they said, was growing inventories of used equipment in distributors' yards, which makes more equipment available for rental purposes. Also, there is reason to believe that the tendency of contractors to rent equipment is becoming more prevalent in some areas than in others, which causes considerable variations in rental rates.

The rates published in this book do not represent actual rates for any one part of the country, but rather national averages published for informational purposes.

Pavement Slipperiness Factors and Their Measurement. Bulletin 186. *Published by Highway Research Board of the National Academy of Sciences—National Research Council, 2101 Constitution, Washington, D. C. $1.60.*

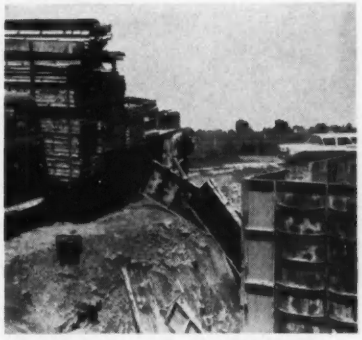
This bulletin presents information on some promising new methods for measuring the resistance to slipping of rubber tires on pavement surfacing materials. The results of both field and laboratory tests are reported. Six of the reports describe how and to what extent the skidding of locked wheels was influenced by different compositions and conditions (wet and dry) of the pavements.

Another paper describes the development of equipment and

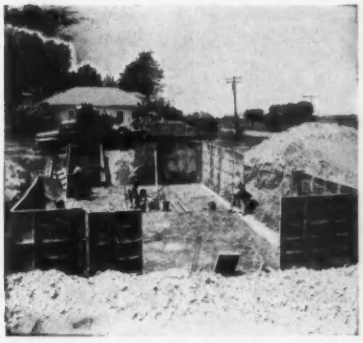
(continued on page 16)

9 to 11 House Foundations Every Week with 5000 sq. ft. of SYMONS Steel-Ply Forms

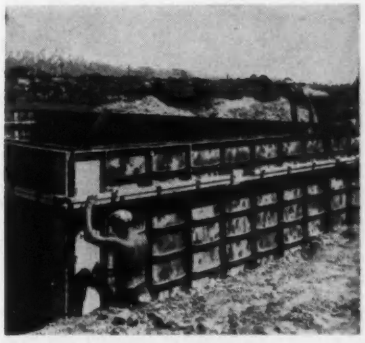
Pouring 9 to 11 house foundations a week is a regular occurrence in the sparsely populated area of Logan, Utah. In fact, Morris J. Smith, the concrete contractor, and his crew with about 5,000 square feet of Symons Steel-Ply Forms have poured more than 400 foundations in 2 years. The plywood has not been turned and is still good for many more pours. Here is a typical example of how Smith achieves speed and economy in his concrete work:



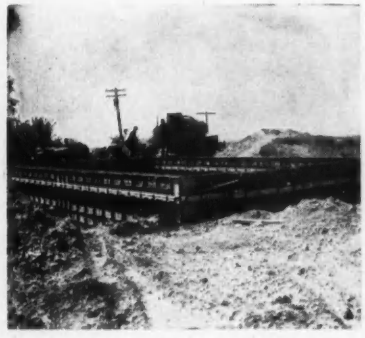
It's 9:00 A.M. . . . Flatbed trucks back on to job. Compartments built on the trucks, separate fillers and panels. Fillers are loaded on the front end and the full size panels are loaded on the back. The truck is used as a warehouse, with each filler and panel having its own specific place. This helps to speed loading and unloading.



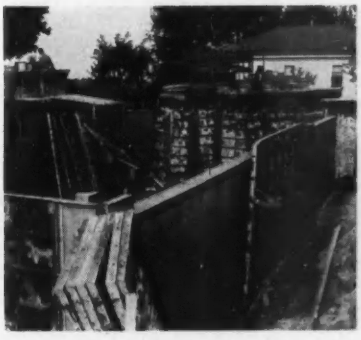
Setting up Four Corners Starts Erection. Each outside corner is erected by one man. The men do not work in pairs . . . each works singly. The outside walls are erected first. By starting at the corners, the men meet in the middle, insert the size filler it takes to finish the foundation . . . forming is completed and ready for pouring.



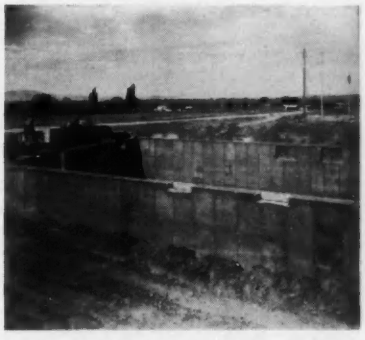
Double 2 x 4 Walers for Alignment. Walers are placed 18" from the top of the 8' panels. There are no walers at the bottom. Waler plates are hung on cross members which helps speed erection. When stripping the forms, buckets are placed close at hand for holding the wedges, waler plates, connecting bolts.



11:00 A.M. Foundation Ready to Pour. Yes, just 10 man-hours to set up 2,000 square feet of forming. And it's an everyday occurrence. Paying local rates ($3.00 an hour) cost of erecting is 1½c a square foot. Stripping in 8 man-hours costs about 1c a square foot. Pouring takes about 6 man-hours.



Stripping and Loading Forms and Fillers. Two men on the outside wall, two men on the inside wall stripping the forms. One man on the flatbed truck loading in a neat, orderly manner. This eliminates stacking, restacking and piling . . . all extra handling operations which cost money. Forms are cleaned before loading on trucks.



24 Man-Hours Later . . . Completed Foundation. Morris J. Smith is an excellent example of a concrete contractor who has put the Symons Forming System to work efficiently and profitably. 9 to 11 house foundations, similar to the one shown above, are poured every week by Mr. Smith and his crew.

a method for determining, by means of pretesting, the potential slipperiness of various road surfaces. Still another paper gives results of the tests made to show the polishing characteristics of certain kinds of aggregates commonly used in pavements.

During the time these studies and developments were in progress in the United States much research on this problem of skidding was being done in Great Britain and some other European countries. A knowledge of this situation brought about the planning of the First International Skid-Prevention Conference at the University of Virginia in 1958.

Highway Pavement Design in Frost Areas, A Symposium: Part 1. Basic Considerations. Bulletin 225. *Published by Highway Research Board of the National Academy of Sciences—National Research Council, 2101 Constitution, Washington, D. C. 131 pp. $2.60.*

This bulletin is the first of a series that is to be developed over the span of several HRB annual meetings on the general subject of highway pavement design in frost areas. The five papers comprising the discussion on basic considerations were presented at a session of the 38th annual meeting as follows: "The Mechanism of Frost Heaving in Soils," by E. Penner; "The Factor of Moisture in Frost Action," by P. F. Low and C. W. Lovell; "Frost Penetration: Relationship to Air Temperature and Other Factors," by M. S. Kersten; "The Factor of Soil and Material Type in Frost Action," by K. A. Linell and C. W. Kaplar; "Frost Action in Soils; A Symposium Analysis," by Carl B. Crawford.

Uniform High Quality Concrete with PLASTIMENT

This 415 foot diameter concrete ring girder will support the retractable, stainless steel dome of Pittsburgh's new Civic Auditorium. Concrete was placed at ambient temperatures varying from 35° F to 95° F. By varying the proportions of PLASTIMENT according to temperature, the water/cement ratio and setting time were kept nearly constant and the quality of concrete, consequently, uniform. PLASTIMENT is specified in over 40,000 cubic yards of concrete for this structure.

To achieve quality and uniformity in concrete with economy, use PLASTIMENT. Call Sika or your nearest distributor for complete technical information.

Owner:
PUBLIC AUDITORIUM AUTHORITY OF PITTSBURGH AND ALLEGHENY COUNTIES
Executive Director: EDWARD FRAHER
Resident Engineer: H. REY HELVENSTON
Architects: MITCHELL & RITCHEY – Pittsburgh, Pa.
Consulting Engineers (substructure):
R. A. ZERN – Pittsburgh, Pa.
Consulting Engineers (superstructure and retractable dome):
AMMAN & WHITNEY – New York, New York
General Contractor:
DICK CORPORATION – Large, Pa.
Ready-Mix Suppliers:
J. K. DAVISON & BRO. – Pittsburgh, Pa.

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Accelerating Densifier	Air Entraining Resin Solution	Expanding Grouting Aid	Integral for Cement Mortar

Circle 112 on reader service card

products

For additional information circle matching key number on reader service card on page 12C.

fastening tool 117

Threaded fasteners are set into concrete at a New York race track, enabling workmen to bolt down box seats quickly. The tool's versatility, speed and efficiency were major factors in meeting construction deadlines, according to the manufacturer. Ramset utilizes the energy of a fired cartridge to set studs or threaded fasteners into concrete. Olin Mathieson Chemical Corp., 460 Park Ave., New York 22, N. Y.

repair material 118

A repair material is said to produce a smooth, and tenacious patch. It is a one-component, dry-mix cement compound which is mixed with water and troweled on to the surface to be finished or patched. Material is suited for toppings to poured concrete slabs and for repairing floors, steps, walls, ramps, sidewalks, driveways, swimming pools and all other concrete surfaces. Larsen Products Corp., Drawer 5938, Bethesda 14, Md.

!W!

NSGA
NATIONAL SAND AND GRAVEL ASSOCIATION
44th ANNUAL CONVENTION

NATIONAL READY MIXED CONCRETE ASSOCIATION
NRMCA
30th ANNUAL CONVENTION

Biennial Show

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- **SHOW DAYS:** Monday, Tuesday, Wednesday, Thursday morning.
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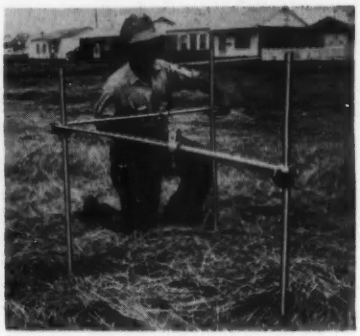
- **ALL REGISTRATIONS** in Exposition Hall Lobby of Conrad Hilton, starting Friday, February 12. Registration and Show admission free to *producers and users* of sand, gravel and ready mixed concrete.

products

For additional information circle matching key number on reader service card on page 12C.



stake-out device 119

Old fashioned stake-out with lumber is eliminated by a rust resistant plated steel and aluminum instrument. Built-in levels in bars provide quick leveling. Retractable Lufkin rules in horizontal bars enable easy locating of positions. Holder eliminates wrapping or tying of string. The device is light, can be reassembled quickly, and is re-usable. Richey Mfg. Co., 2801 Rochester Road, Springfield, Ill.

forming booklet 120

Items of interest to contractors and engineers engaged in concrete forming are featured in a 16-page booklet, "Universal Concrete Forming News." Universal Form Clamp Co., 1238 N. Kostner Ave., Chicago, Ill.

sidewalk canopies 121

Four-page bulletin, illustrated with photographs and technical data, shows how to use 6-foot wide sidewalk canopy frames and why pedestrian traffic gains greater mobility and safety. Included are application details of primary interest to those engaged in overhead construction work in heavily populated areas. The Patent Scaffolding Co., Inc., 38-21—12th St., Long Island City 1, N. Y.

testing equipment 122

Bulletin describes 8 new or improved models of testing apparatus for soils, asphalt, concrete and other construction materials. Soiltest, Inc., 4711 W. North Ave., Chicago, Ill.

hand trowel 123

A process by which all blades are honed accurately to within 1/1000 of an inch is said to produce an easier-to-use, longer lasting tool. The cement or plastering trowel blade, already locked to the lightweight forged aluminum handle, is magnetically locked into a specially designed machine that hones the blade more accurately than is possible with hand finishing. In addition, the use of power pins instead of rivets puts less strain on the blade during manufacture, which also tends to give a flatter blade. Goldblatt Tool Co., 1910 Walnut St., Kansas City 41, Mo.

finishing equipment 124

A new catalog 580, perforated for insertion in a loose-leaf binder, contains complete information about Stow's vibrators, grinders, rotary trowels and screeds. Photographs of the equipment in use illustrate the catalog. The information presented is valuable to all concerned with finishing concrete. Additional sheets 53, 587, 5725, 5912 and 5914, also perforated, give excellent discussions on grinding concrete, the use of the vibrating screed and vibration of concrete. Stow Mfg. Co., Binghamton, N. Y.

products

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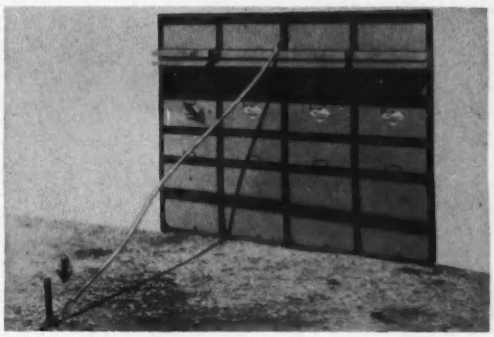
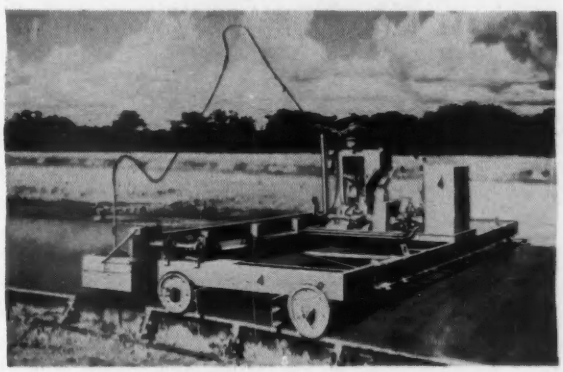


form brace 125

Adjustable steel form brace and brace extension (see arrows) available for use with a line of prefabricated concrete forms and forming hardware make bracing with wooden 2 x 4's obsolete. Steel braces more economical since they can be re-used indefinitely. Also provide more positive alignment and less distortion than possible under old methods of bracing. Brace and brace extension may also be used on built-up forms employing wooden stakes. Symons Clamp & Mfg. Co., 4249 Diversey Blvd., Chicago 39, Ill.

spray curing machine 126

An automatic spray curing machine adapted to belting and brooming operations and fitted for an optional burlap drag attachment delivers a uniform flow of curing compound and by means of a by-pass system returns overflow to a storage drum. Its spray head is operated by a hydraulic V-belt drive—independent of travel speed. An adjustable frame with simple clamping devices eliminates the use of nuts and bolts, thereby affording quick width adjustments. Four standard sizes are available. Chain Belt Co., 4701 W. Greenfield Ave., Milwaukee 1, Wisc.



products

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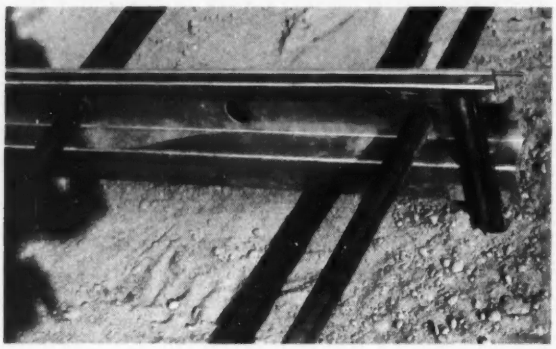
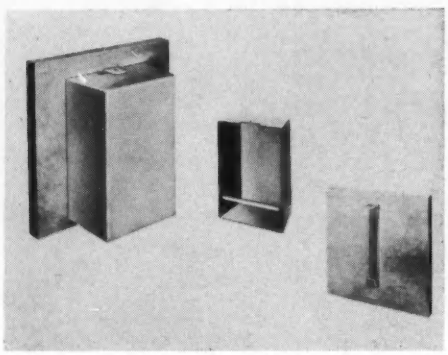


joint form 127

Galvanized sheet metal strip in keyed tongue and groove shape provides form, screed, and cold joint which remains in slab. Holes on 6-foot centers allow No. 10 wire to be inserted in 12-inch lengths for lapping immediately after placing concrete. Kold Joint Form eliminates installation and stripping of forms and is said to provide better joints. W. J. Burke & Co., 2690 Harrison St., San Francisco 10, Calif.



metal beam pocket 128

A metal beam pocket designed to simplify the forming of beam pockets is adaptable to beam depths of 6, 8, 10 and 12 inches, and has a tapered shape which assures easy stripping. Made of heavy gage steel, the unit is light in weight and easy to handle. It consists of 2 components, a formed metal clamp which is nailed to the inside form and a pocket which is slipped on to the clamp and which makes snug contact for forming an accurate pocket. Simplex Forms System, 5605 Industrial Ave., Rockford, Ill.

products

For additional information circle matching key number on reader service card on page 12C.

waterstops 129

Bulletin 70 describes a pvc waterstop which is said to be engineered with an improved cross-section design and extruded of a special, top-quality polyvinylchloride thermo-plastic with added plasticizers and stabilizers to provide all the necessary qualifications of an effective waterstop. Directions for simple splicing procedures are included, as well as specifications for all sizes and types. Other available products listed in the bulletin include vapor barrier membrane, perimeter insulation asphalt liners, expansion joints, joint sealing compounds, silicone waterproofing, concrete curing compounds and air entraining agents. W. R. Meadows, Inc., 2-18 Kimball Street, Elgin, Ill.

tunnel concrete 130

How excavating and concreting problems encountered on 12 major tunneling projects were solved is the subject of bulletin MBR-P8. The book provides valuable aid to engineers planning tunnel projects. Highway, railway, and water tunnels and their construction techniques are illustrated by photos and accompanying texts. Among the projects included in the study are the Hydro-Quebec Bersimis job and its unique concrete requirements, The Aluminum Company of Canada's Kemano project with its huge underground powerhouse and the extreme water and heat conditions encountered at Tecolote, California. The Master Builders Co., Cleveland 3, Ohio.

products

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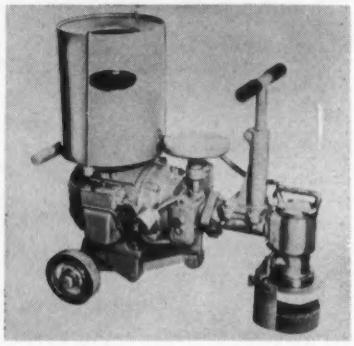

border machine 131

A short shaft border machine, smaller and lighter than the standard heavy duty border machine, has nearly equal abrasive pressure on the stone. Stone travels at the same high speed as on the heavy model, providing nearly as much grinding capacity. Long service life is claimed for the equipment. Terrazzo Machine & Supply Co., 2536—24th Ave. South, Minneapolis 6, Minn.

retardant coating 132

A white water-in-oil emulsion of heavy consistency is used as a coating on prestress tendons to retard the set of concrete around the steel until the structural member has reached tensioning strength. The locally-retarded concrete ultimately develops considerable strength. Application of the material eliminates the time consuming and costly wrapping or encasing of prestressing strands, cables, wires or bars, in either pretensioned or post-tensioned structural members. Wrapping operations and cumbersome expensive large casings, which increase the difficulties of placing concrete and which reduce cross-section area, are eliminated. Sika Chemical Corp., 35 Gregory Ave., Passaic, N. J.

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